It may not be out of place to refer to the complex requirements of a successful eclipse expedition. The installation of a dozen instruments in a permanent observatory, with skilled and technical assistance available, so that all the instruments will work well when required, is not a simple matter. The dozen instruments at a temporary eclipse station, where skilled assistance is not available, must work equally well *at a given second of time.*

After our eclipse duties were over, we visited, with pleasure and profit, the most of the leading observatories of the country, and attended the annual meeting of the Astronomical and Astrophysical Society of America, in New York; returning to the Lick Observatory in the last week of July.

OBSERVATIONS OF THE ZODIACAL LIGHT FROM JANUARY, 1899, TO JULY, 1900.

By Francis J. Bayldon, R. N. R.

(ABSTRACT.)*

I. General Remarks.

All observations were made at sea. From January to August, 1899, our voyages were from Sydney to Wellington (N. Z.), Suva (Fiji Is.), Honolulu, Victoria (Vancouver Is.), and Vancouver (B. C.). Since August, 1899, the voyage is from Sydney to Brisbane (Queensland), Honolulu, Victoria, and Vancouver. The round voyage from Sydney to Sydney takes nine weeks, including two weeks' stay at Vancouver. In Sydney we remain for three weeks. If necessary, the average speed of the ship may be considered as fourteen knots per hour.

From January to August, 1899, the observations were chiefly made during my watch on deck from 8 to 12 P. M. aboard the R. M. S. *Aorangi.* From August to the present time they have been made from 7 to 9 P. M., and from midnight to 4 A. M. aboard the R. M. S. *Warrimoo.*

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*Mr. Bayldon's paper is too extensive to be printed in full in our *Publications.* With his consent, we therefore present this abstract, which gives in full the notes made on a few nights. The original paper is on file in the library of the Society.— The Committee on Publication.

The star-charts chiefly used are PROCTOR'S "Small Star Atlas," and an old "Celestial Atlas" by JAMIESON, published at the beginning of the century. As both outlines and the line of central axis are given, it is hoped that any clerical errors or mistakes will be easily recognized.

A great many of the observations were corroborated by officers or passengers who happened to be handy. Observations of the Light are very rare in the Pacific between November and April on account of the great amount of cloud then present.

Latterly, I have endeavored to form some idea of the intensity of the Light by imagining a table of intensity, ranging from 1 = Light just visible as a diffused glow, outlines unobtainable, to 10 = very bright, equal to the brightest portions of the Galaxy, *at their brightest.*

II. OBSERVATIONS.

1899. January 9th—Lat. 13½° S.; Long. 177° W.

8 to 10 P. M.—Very clear night. Light very distinct, considerably brighter than the Galaxy. The western cone very bright to an elongation of about 105°. Diffused light widely extended on both sides. Beyond the apex, diffused light appeared alternately nearer the *Pleiades*, and α and β *Arietis*, and *Aldebaran* and α and γ *Ceti.*

In *Sagittarius*, *Capricornus*, *Aquarius*, and *Pisces*, the line of central axis lay from 4° to 0° south of the ecliptic, the breadth of the Light ranging from 30° at an elongation of 30°, to 12° at elongation 105°.

In *Aries* and *Taurus* the line of central axis lay from 0° to 1° north of the ecliptic, the breadth of the Light varying from 12° to 8° at elongation 140°. The Gegenschein distinct from near Σ to β *Geminorum*, oval-shaped, but the glow of *Mars* completely spoils observations.

February 1st — At Comox, Vancouver Island, Lat. 49½° N.; Long. 124° W.

8 P. M. to 11:30 P. M.— Very clear, frosty night. Thermometer 20° F. Magnificently clear air. The western cone as bright as the Galaxy in *Perseus*, extending to the *Pleiades*, about 65° altitude, 20° broad in *Aries*, lower portion apparently enormously displaced to the northward in *Andromeda* and *Pegasus*, but land interfered with observations at a low altitude, as did the Galaxy and *Mars* at very high ones. The Light was distinctly

visible from the Gegenschein to near the eastern horizon below the Sickle. Apex of western cone at 105° elongation. At 11:30 clouds formed and the glow of Aurora Borealis appeared to the northward. Outlines of the Light were obtained as follows:—

Northern Boundary.	Line of Central Axis.	Southern Boundary.
2° N. of γ *Pegasi.*	δ *Piscium.*	ι *Ceti.*
α *Arietis.*	ε *Arietis.*	2° S. of ξ′ "
5° N. of *Pleiades.*	*Pleiades.*	1° N. of μ *Tauri.*
	β *Tauri.*	
[Galaxy intervenes.]		
½° N. of α *Geminorum.*	1° S. of ι *Geminorum.*	δ *Geminorum.*
Gegenschein.		
Near μ *Leo Majoris.*	1° S. η *Leo Majoris.*	ο *Leo Majoris.*
" ζ " "	Just N. of β *Virginis.*	3° N. of η *Corvi.*
β " "	2° N. of α "	4° N. of γ *Hydræ.*
3° N. of δ *Virginis.*		
Just N. of ζ "		

Diffused light apparently extended through *Triangula* about to β *Andromedæ* and wholly embraced the Square of *Pegasus.*

May 9th— Lat. 33° N.; Long. 147° W.

10:45 to 11:15 P. M.—Magnificent observations. Light faint, but distinctly outlined. Western branch just touches *Virgo.* Rising Galaxy humbugs eastern horizon. Night very clear. Outlines as follows:—

North.	Central Axis.	South.
1° N. of α *Geminorum.*	Just N. of ι *Geminorum.*	δ *Geminorum.*
ε *Leo Majoris.*	" S. of β "	2° S. of *Præsepe.*
1° N. of γ " "	η *Leonis.*	1° S. of α *Leonis.*
3° S. of θ " "	1½° N. of σ "	τ "
2° S. of π *Virginis.*	1° N. of β *Virginis.*	2° S. of β *Virginis.*

June 28th—Lat. 14° S.; Long. 177° W.

Apparently clear sky, but as cirrus haze was prevalent during the day, presume it is also about to-night, especially as stars are not very bright. Slight cumulus at times. From 7 to 9 P. M. western cone appeared narrow, with hard

outlines, especially to the southward, and no diffused light was seen. At times it nearly equaled the Galaxy, at times rivaled stars of the third magnitude. Only the concentrated bright central portion was visible. Not visible beyond *Jupiter*. At 10 P.M. the central axis appeared 1° more southerly. The southern boundary then extended nearly to δ *Corvi*, the northern to δ *Virginis*.

At 11:15 P. M. the Moon rose, making cirrus streaks apparent.

June 29th — Lat. 9° S.; Long. 175° W.

Cirrus haze and cumulus, with occasional showers and bright, clear intervals. Light observed from 7 P. M. to midnight. Light was bright, extending to the zenith, but gradually faded as the night progressed, particularly to the northward, thus throwing the line of central axis more southerly. No trace of Light beyond *Jupiter*. Moon rose about midnight. Between 7 and 9 P. M. boundaries were noted as follows:—

NORTHERN.	CENTRAL AXIS.	SOUTHERN.
2° N. of μ *Leo Majoris.*	From about *Præsepe*	ζ *Hydræ.*
Just S. of β " "	Just N. of α *Leonis.*	4° N. of μ *Sextantis.*
δ *Virginis.*	" S. of χ "	Midway { θ *Crateris.* ε "
Jupiter.	1° S. of β *Virginis.*	η *Corvi.*
	α "	7° S. of α *Virginis.*

REMARKS—*June 28th, 29th, 30th.*

Thin cirrus haze and streaks prevalent throughout each day, and therefore during the nights. They give the Light a hard, apparently true outline, no diffused light either above cone or on either side being visible. The cone generally appears long and narrow, but by continued watching the utmost extent can be obtained — first one boundary, then the other. At times, as one side may be curtailed more than the other, the line of central axis appears to move about, and the true position is only derived by taking the utmost boundaries derived from time to time. If the cirrus streaks lie east and west, it is very hard indeed to distinguish between them and the actual Light. Cirrus haze is frequently unnoticeable when over the bright center of Light, except as it tends to equalize it into a uniform glow with no

markedly brighter central portion. When haze thinly overspreads the sky, its presence can only be detected by constant careful watching.

August 5th — Lat. 15° N.; Long. 161½° W.

10 P. M. to midnight, the sky was clear, but the western branch of the Light too low for good observations. The Gegenschein was distinctly visible as an oval at right angles to the ecliptic situated around ι, τ, *29 Capricorni*, and to the N. and S. of this center extending nearly to *ν Aquarii*, *θ Capricorni*, ε *Capricorni*. At times it also seemed to include ε, κ, δ *Capricorni*, extending nearly to λ *Capricorni*, thus seeming circular, but with a *vacant* center, no light being visible between τ and γ *Capricorni*. It also had faint connecting bands running E. and W. about 4° broad. . . .

August 10th — Lat. 9½° S.; Long. 175° W.

. . . The Gegenschein visible from 8 P. M.; circular, with blank central space as before, but the whole was brighter than of late, and the blank space showed the slightest luminosity (though still darker than the surrounding portions) when overhead at 11 P. M.

The eastern branch was quite distinct at 10 P. M. (the night being magnificently clear); broad, too, and more southerly than of late. It consisted of a bright central portion about 10° broad, inclosed by diffused light. The Gegenschein was part of this bright central portion, surrounded, especially to the southward, by diffused light. The blank central space of the Gegenschein appeared the darkest spot in the Zodiacal Band as the eye traced it from the eastern horizon to the Galaxy. . . .

November 15th—Lat. 11° S.; Long. 169° E.

The Light was very distinct between 4 and 5 A. M., when the sky cleared. Its intensity equaled 6 to 7 in *Gemini*, *Leo*, and *Virgo*, evidently much as would be expected, lying along the usual line of central axis, 22° to 12° broad; so gave all my attention looking out for the *Leonids*. (Another *Leonid* observer asked me the next day, what the "curious white rainbow" was which he had noticed!)

1900. April 26th—Lat. 19¾° S.; Long. 161½° E.

. . . Between 2 and 2:45 A. M. the sky became very clear, and the eastern Light continually increased in altitude, breadth,

and intensity (= 3 to 6). The Gegenschein became larger and brighter, circling round *89*, *85*, *86*, *94 Virginis*, continuing round 3° E. of λ and 3° S. of α to *89 Virginis*, its center being about 3° S. W. of λ *Virginis*. The western Light also became distinct (intensity = 3), broader, and cone-shaped, continuing till Moon rose at 2:45 A. M.

Remarks on the Light in April, 1900.

During the evening the Galaxy and *Venus* have sadly spoiled observations; but it has seemed as if there were hardly any brighter western cone — the Light appeared uniformly diffused, gradually becoming too faint for observation. However, into *Cancer* it could be traced with a fair amount of certainty, but in *Leo* its outlines have been very uncertain and unreliable, especially the northern. In *Virgo* and *Libra* again, outlines have been more reliable, especially soon after midnight.

The Gegenschein appeared fainter as the month progressed. Each night as the twilight glow subsided, a bright glow extended from near *Orion's* head into *Cetus* on the horizon.

The eastern Light invariably first appeared widely diffused, then gradually the central portion became brighter and formed a bright narrow cone, with apex between γ and η *Capricorni*, though as the steamer came south, the diffused Light on the southern edge of the cone was frequently visible when the northern diffused Light had quite disappeared.

May 23d—Lat. 29° S.; Long. 153½° E. (off Queensland Coast). Moon's age, 24 days.

Air very clear; all stars very bright and clear. Galaxy = intensity 10.

6:30 P. M.—Galaxy and Zodiacal Light distinctly separated from *Gemini* at the western horizon. Light = Galaxy = 10, in *Gemini* and *Cancer*. Clouds intervene.

7:30 P. M.— Light visible around the sky to *Scorpio*, 10° above eastern horizon. Intensity = 5 in *Gemini* and *Cancer;* 4 in *Leo;* 3 in *Virgo* and *Libra*. *Venus* setting.

8:00 P. M.—Light brighter = Galaxy = 8 in *Gemini*, *Cancer*, and *Leo;* 6 in *Leo* and *Virgo;* 3 to 2 in *Libra*.

During this time in *Leo*, *Cancer*, and *Gemini*, the line of central axis appeared much displaced to the southward. The brighter portion ran along a line *Præsepe*, *Regulus*, *Spica* about 6° broad;

to the northward of this brighter portion there was no diffused light, whereas diffused light extended 10° to 8° along its southern outline. Hence the southerly displacement of the central axis.

Jnly 4th—Lat. 33½° N.; Long. 147° W. Moon's age, 7 days.

Misty night, with frequent breaks of intensely clear sky. Could distinguish twelve stars in the *Pleiades* with the naked eye. (o *Ceti* appears to be as bright as γ *Ceti.*) Galaxy = intensity 9 in *Scorpio*, fading to 0 in *Perseus* and *Taurus*. Zodiacal Light just discernible from 2:00 A. M. At 3:00 A. M. the Light = intensity 6 in *Aries* and *Pisces*. Light extended from *Pleiades* (cloudy below this point) to a few degrees beyond δ *Piscium*, the southern outline being best defined. Very hard to distinguish northern outline N. of *Pleiades* from twilight. No trace of Light in *Aquarius*.

A glow, roughly contained between *t*, *v*, λ, ζ *Sagittarii*, may be the Gegenschein or may be due to the Galaxy.

R. M. S. "WARRIMOO," July 6, 1900.

PLANETARY PHENOMENA FOR SEPTEMBER, OCTOBER, NOVEMBER, AND DECEMBER, 1900.

BY MALCOLM MCNEILL.

SEPTEMBER.

The Sun reaches the autumnal equinox September 23d, 4 A. M., P. S. T.

Mercury rises about an hour before the Sun on September 1st, but rapidly approaches superior conjunction, reaching it on September 13th, and becoming an evening star, but does not get far enough away for visibility during the rest of the month.

Venus is a morning star, and rises about three and one half hours before sunrise. It reaches its greatest western elongation, 46°, on the night of September 16-17th. It moves about 30° eastward and 4° southward from *Gemini*, south of *Castor and Pollux*, through *Cancer* into *Leo*, and at the end of the month is about 6° west and north of *Regulus*.

Mars rises before 1 A.M. It moves about 18° eastward and 3° southward from *Gemini* into *Cancer*. During the early part